

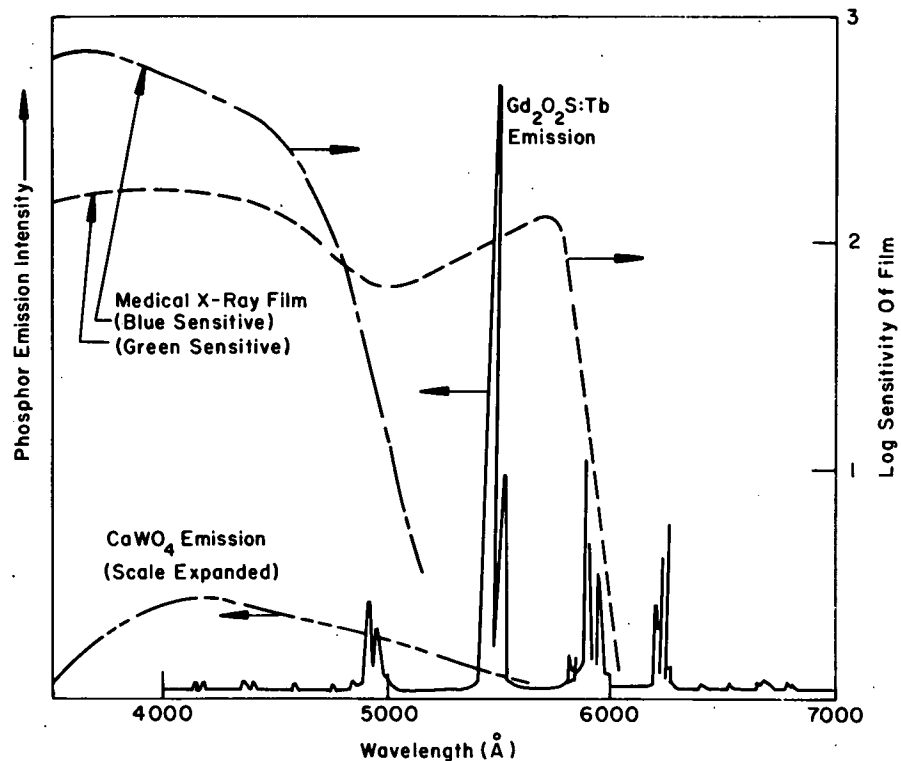


# AEC-NASA TECH BRIEF



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## Improved Intensifying Screen Reduces X-Ray Exposure



Spectral Emission of  $\text{CaWO}_4$  and  $\text{Gd}_2\text{O}_2\text{S:Tb}$

A terbium-activated gadolinium oxysulfide ( $\text{Gd}_2\text{O}_2\text{S:Tb}$ ) intensifying screen increases the sensitivity of x-ray film by a factor of 2 when compared to a standard calcium tungstate ( $\text{CaWO}_4$ ) screen. Optimizing the film to this new x-ray phosphor can increase film sensitivity by a factor of 20. Consequently, x-ray exposure can be reduced comparably without changing the quality of present images.

Terbium-activated gadolinium oxysulfide has over five times the intrinsic luminescence efficiency of  $\text{CaWO}_4$ , with its emissions primarily in the green spectral range near 5400 Å. Calcium tungstate, on the other hand, emits a broadband which peaks in the blue spectral range near 4200 Å. The figure compares the two spectra; the  $\text{CaWO}_4$  intensity scale is expanded for clarity.

(continued overleaf)

The spectral sensitivity of medical x-ray film (see figure) has developed over the years to match the blue emission from  $\text{CaWO}_4$ . The sensitivity range of this blue-sensitive film does not include the principle emission from  $\text{Gd}_2\text{O}_2\text{S:Tb}$ . There does exist, however, a green-sensitive film with the spectral sensitivity range shown. Using the green-sensitive film with a  $\text{Gd}_2\text{O}_2\text{S:Tb}$  screen, 1/18 of the x-ray exposure is needed to get film darkening equivalent to that obtained using a  $\text{CaWO}_4$  screen. Using the blue-sensitive film with a  $\text{Gd}_2\text{O}_2\text{S:Tb}$  screen, 1/2 the exposure is needed for equivalent darkening. An even larger exposure reduction (about 1/20 of that presently required) will be possible when a new photographic film with maximum sensitivity near 5400 Å is developed for the new screens.

The new x-ray intensifying screen may make possible new radiographic procedures where detection speed and x-ray tube power have previously been the limiting factors. It will also significantly reduce the total population exposure to harmful radiation in the United States.

#### Note:

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#### Patent status:

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